Remarks/Arguments

In an Office Action dated June 13, 2001, an objection was made to the specification and claims 1-49 were rejected. The specification is corrected, many claims have been amended to clarify them and new claims 50 to 57 have been added.

Background

Prior to addressing the rejections, it is believed that some background will be very helpful. The claims all relate to Fibre Channel switching and operations within Fibre Channel switches. The cited references are all based on ATM (asynchronous transfer mode). While both relate at very high levels to packet switching, the similarity ends just below the high levels and are clearly very different at the level of the claims of this case.

Fibre Channel is a connectionless protocol. Each frame contains a source address and a destination address. Frames are routed through the switched fabric based on the destination address. Each frame travels individually through the fabric. Each switch that receives the frame individually determines on which port it needs to transmit the frame. The source device simply launches a frame into the fabric, with no other operations basically necessary to have the frame reach its destination.

ATM, on the other hand, is a connection-based network. Before two devices can communicate, they inform all intermediate switches of their need for a connection. This connection is then called a virtual circuit or virtual channel (VC). *See* p. 7, first paragraph in the "A Brief Overview of ATM: Protocol Layers, LAN Emulation, and Traffic Management" cited in the accompanying Information Disclosure Statement. With the virtual circuit thus defined, virtual path identifiers (VPIs) and virtual channel identifiers (VCIs) are then used in each switch to route the cells from endpoint to endpoint. *See* p.9 of "A Brief Overview." The VPI/VCI pairs only are relevant to a local link. They have no global significance. They are just used for local routing.

A good explanation is provided on p. 2 of "Asynchronous Transfer Mode Overview" as also listed in the IDS. First a virtual channel is created and a virtual path is established from switch to switch. At each interface in the network VPI/VCIs are established, again noting that

these only apply very locally. A cell is sent out and the VPI/VCI values are changed at each switch along the way, with the VPI/VCI thus acting as a "destination address" in each switch. When the virtual path is no longer needed, i.e., the connection is terminated, the virtual path is dismantled and the VPI and VCI values returned to their respective pools.

In embodiments according to the claims, completely different operations are used. First, as noted above, this is a Fibre Channel environment. Therefore there is no concept of a connection as is fundamental to ATM. Fibre Channel uses addresses for each end node, with the source and destination addresses contained in the header of each frame. It is the destination addresses that are used for routing the frames. To address potential blocking issues, the embodiments add virtual channels onto this environment. Routing is still done based on destination addresses, but buffer space on the various switches is allocated based on both destination addresses and virtual channels. If two end nodes are accessed through a single port in a given switch, the use of virtual channels and related separate buffers allows each end node to proceed individually. That is, if one of the two end nodes backs up and fills its related buffers in the switch, the other end node can still proceed as it has separate buffers due to a different virtual channel assignment. Thus it is clear that the virtual channels in the present claims are over and above the addresses used for routing, which are always present in a Fibre Channel frame.

This is in contrast to the cited ATM references, where effectively only routing addresses are utilized. There is no equivalent in the cited ATM references to the virtual channels of the claims. This is true even though ATM uses the words "virtual channel" to describe its operation. One cannot just look at the words in the abstract. One must consider the function being described by the words. In ATM "virtual channel" and its related VPI and VCI perform the routing function. In the claims the destination address present in the specified Fibre Channel frames serves the routing function. The virtual channels of the claims perform a different function, basically allowing data flows being routed out the same port to be separated to prevent blocking issues. None of the cited ATM references indicate this different function is present, especially not for the "virtual channel" defined in ATM.

Applicants thus submit that it is required to look past the facially similar wording of the ATM references and the present claims to the underlying function defined by the words. When

this is done, it is very clear that the ATM references are not relevant to the present claims. This argument is hereby incorporated into each claim discussed below and is listed here and not necessarily each time to shorten this response.

§102 Rejections

Claims 1-3, 5-7, 14, 16 and 20 were rejected under § 102(b) over Yunten. Applicants traverse this rejection.

Claim 1

The Office Action commences by equating a Fibre Channel switch and an ATM switch. As Applicants have explained at length above, it is submitted that Yunten is not a proper reference. The two switches work on completely different principles and are not analogous for purposes of the present claims. This is very clear when "virtual channel" is properly interpreted in each context. Claim 1 clearly requires operations for Fibre Channel data frames. This inherently means that destination addresses are used for routing. The claim then requires choosing a virtual channel. Thus the virtual channel is something beyond routing functionality. Yet the virtual channels in Yunten, as true in ATM generally, are only relevant to routing functions. Thus any references to virtual channels, VPIs or VCIs in Yunten do not teach or suggest the function of the virtual channels in Claim 1.

Claim 1 further requires "providing information in addition to the Fibre Channel data frame to identify the first virtual channel." The Yunten reference clearly does not perform this step. In ATM, and Yunten, the VPI and VCI values are part of the cell or frame. They are not provided in addition to the frame. Thus this specific claim element is not present in the reference.

Claim 3

Claim 3 specifically requires that the "additional information identifying the first virtual channel is included in an inter-frame fill word." This is coupled with the claim 1 requirement that the information is in addition to the Fibre Channel data frame. Therefore the argument in the Office Action that the frame header can perform this inter-frame fill function is improper. Further, in any event it is clearly improper to call a frame header an inter-frame fill word. By

definition "inter-frame" means it is between frames and not part of a frame. The header is part of a frame and thus cannot be between the frames.

Therefore the rejection of claim 3 is improper based merely on the words themselves and further when the specific claim limitations are considered.

Claims 5 and 6

Claim 5 requires the first virtual channel to be chosen based on the source of the Fibre Channel data frame, while claim 6 bases it on the destination. The Office Action references the VCI assignment in Yunten to meet the claims. But, as noted above, the VCI of Yunten is not and cannot be equivalent to the virtual channel of the current claims. The VCI is a routing parameter and the virtual channels of the claims are not. Therefore claims 5 and 6 are allowable.

Claim 7

Claim 7 requires the first virtual channel to be chosen based on the identity of the first source port. The cited portion of Yunten only indicates that the VCI is selected by the interface unit. As described above, this is not equivalent to a virtual channel as required in the claim. The VCI is just a routing component, as clearly described in Yunten, not a virtual channel as required in the claim.

Claim 14

Applicants again note that the virtual channels of the claim perform a different function from those in Yunten, so the use of the same wording is not controlling. Because Yunten does not show functions similar to the claimed virtual channels, the rejection is improper.

Further, claim 14 requires the second virtual channel be provided as information in addition to the Fibre Channel data frame. As previously discussed with regard to claim 1, the ATM switch of Yunten does not perform this element, so the claim is further allowable.

Claim 16

The arguments regarding claims 5 and 6 apply equally to claim 16. Therefore Applicants submit the claim is allowable.

Claim 20

Claim 20 requires a first virtual channel, which is selected by the first small switch and sent to the second small switch, then the second small switch selects a second virtual channel and sends it to the third small switch. The third small switch then sends the frame to the destination. Yunten does not teach or suggest this structure. The first VC switch of Yunten may do VCI translation (again noting that VCIs are not equivalent to virtual channels as claimed, but assumed arguendo here). Thus in Yunten to have three switches involved the frame would go to the VP switch, which would not select a VCI, and then to the destination VC switch, which may do a VCI translation. Thus the destination VC switch cannot be the third small switch because it is only the second switch in Yunten that selects VCI values. Thus the structure and steps of claim 20 cannot be met, even if the VCIs are improperly treated as being equivalent to virtual channels of the claims.

For that reason and the underlying differences between the VCIs of Yunten and the virtual channels of the claim, the claim is allowable.

§103 Rejections

Claims 8-10 were rejected under § 103 over Yunten. Claim 4 was rejected over Yunten and Kilkki. Claims 11, 15, 21, 23-36 and 46-49 were rejected over Yunten and Bandai. Claims 12, 13, 17-19 and 22 were rejected over Yunten and Endo. Claims 37-45 were rejected over Yunten, Bandai and Endo. Applicants traverse the rejections.

Claims 8 – 10

Claims 8-10 are submitted as being allowable as being dependent on allowable claims 1 and 7 and because the VCI in Yunten does not properly correspond to the virtual channel in the claims.

Claim 4

Claim 4 is submitted as being allowable as being dependent on allowable claim 1 and because the VCI in Yunten does not properly correspond to the virtual channel in the claims.

Claim 11

Claim 11 is submitted as being allowable as being dependent on allowable claims 1 and 7 and because the VCI in Yunten does not properly correspond to the virtual channel in the claims.

Claim 15

Bandai shows a cell buffer associated with each input port. Applicants agree with the Office Action on this point. However, the Office Action then states that each port is associated with a virtual channel. That is not shown in Yunten. Yunten suggests a VCI value per interface unit. That would lead to a buffer for each interface unit. But the claim calls for the virtual channels to have a respective buffer in the second small switch. Referring to Yunten, the second switch would be the VP switch or the second VC switch. However, in both cases Yunten only shows one input port in this switch, thus indicating only one buffer. But the second VC switch would have 18 VCIs/interface units. So the second VC switch would have only one buffer (from the VP switch) but 18 VCIs. In contrast, the claim requires one buffer per virtual channel in the second small switch. Thus Yunten and Bandai do not show or suggest the claim for this reason.

Claim 21

Like arguments made with respect to claim 15 apply to claim 21, further amplified in that two of the Yunten switches (VP switch and second VC switch) both show only one input and thus one buffer.

Claim 23

Claim 23 is allowable for the reasons stated with regard to claim 15 and with regard to claim 1. Similar to claim 15, claim 23 requires buffers associated with virtual channels and the Yunten/Bandai combination do not teach this. Claim 23 also requires a memory storing identity of a virtual channel associated with each source port. This is clearly not taught by Bandai as it only has one buffer per input port and thus would not have the required memory. Further, similar to claim 1, claim 23 requires providing information identifying the virtual channel in addition to the Fibre Channel data frame, also not shown by Yunten. Therefore claim 23 is allowable.

Claims 24 and 25

The arguments from claims 5 and 6 apply equally to claims 24 and 25 so that they are further allowable.

Claim 28

Claim 28 highlights the fundamental problem applying the ATM prior art to the present claims. In Yunten the Figure 4 table is effectively the routing table, but it only includes routing information, *i.e.*, the VCI values as those are routing values in ATM and Yunten. There is then nothing in the Figure 4 table to correspond to the virtual channel identifier required in claim 28. Therefore claim 28 is allowable.

Claim 29

Claim 29 is allowable based on the remarks with regard to claim 28 and to claims 5 and 6.

Claim 30

Claim 30 is allowable based on the remarks with regard to claim 28 and to claim 3, as claim 30 includes the requirement of the inter-frame fill and including virtual channel identification information.

Claim 31

The arguments relating to claim 23 apply to claim 31.

Claim 32

Arguments of claims 23 and claim 1 apply equally to claim 32, so that it and its dependents are allowable.

Claim 36

Arguments similar to those of claim 3 apply to claim 36, as claim 36 requires retrieving virtual channel identity from the inter-frame fill word. As Yunten does not even show the inter-frame fill word or its inclusion of virtual channel identity, its use cannot be taught or suggested so that the claim is allowable.

Claim 46

Similar to claim 23, claim 46 requires buffers associated with virtual channels and a memory storing identity of a virtual channel associated with each external port. Therefore claim 46 is allowable for similar reasons.

Further, claim 46 also highlights the fundamental difference between Fibre Channel and ATM by separating the destination of the frame and the virtual channel on which to output the frame, clearly indicating that routing is separate from virtual channels. In contrast, the VCI values on Yunten are routing values, there being nothing in Yunten equivalent to virtual channels as claimed.

Claim 47

Similar to claim 28, claim 47 requires router table entries of a destination and a virtual channel. The tables in Yunten only show the destination (the VCI) and do not show a virtual channel. Therefore claim 47 is further allowable.

Claims 48 and 49

The arguments of claims 5 and 6 apply to claims 48 and 49.

Claim 12

As above in several instances, claim 12 also highlights the disparity between the VCI of Yunten and the virtual channel of the claim. Yunten does actually retrieve the identity of a port from the routing table, it just happens to call it the VCI. So Endo actually adds nothing to Yunten relating to destination or port entries. Endo also does not address the lack Yunten in sending the information identifying the virtual channel in addition to the Fibre Channel data frame. It may add the output interface number, but that is not a virtual channel but rather a port number at best. Thus claim 12 is allowable.

Claim 17

Claim 17 also highlights the difference between VCI and claimed virtual channel by looking up identity of the destination (in Yunten the VCI) and choosing a virtual channel based

on that destination. Yunten clearly cannot do the two steps and Endo does not teach or suggest the claimed relationship.

Claim 18

The arguments with regard to claim 47 apply to claim 18 so that it is allowable.

Claim 19

As with claim 17, claim 19 clearly differentiates ports and virtual channels, not shown or taught in Yunten, with Endo not adding more. Further, the additional information transmission arguments of claim 1 apply.

Claims 38 and 39

The arguments of claims 5 and 6 apply here so that claims 38 and 39 are allowable.

Claim 40

As argued above many times, the specific reference to retrieving a port from a routing table highlights the references not teaching the requirements of the claimed virtual channels.

Claim 41

As argued above, retrieving the virtual channel from a routing table is not taught or shown as this reference only shows retrieving routing information, not virtual channels as claimed.

Claim 45

Claim 45 adds inter-frame fill word requirements as frequently argued above is not shown or suggested in any of the references.

## Conclusion

Applicants submit that claims 1 - 49 are allowable, either on their own right as argued above, or as being dependent on allowable claims. Applicants further submit that new claims 50 - 57 are allowable.

Respectfully submitted

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September 13, 2005 Keith Lutsch
Date